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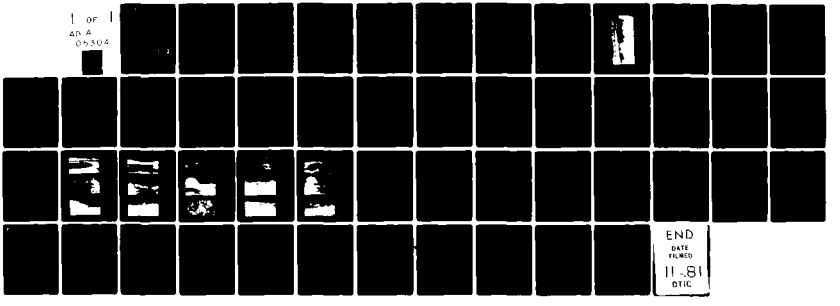

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LEVEL

MISSOURI
OSAGE-GASCONADE BASIN

MO NONAME 408 LAKE DAM

OSAGE COUNTY, MISSOURI

MO 30580

AD A105304

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: HOSKINS-WESTERN-SONDEREGGER, INC.

FOR: STATE OF MISSOURI

SEPTEMBER, 1978

UNCLASSIFIED

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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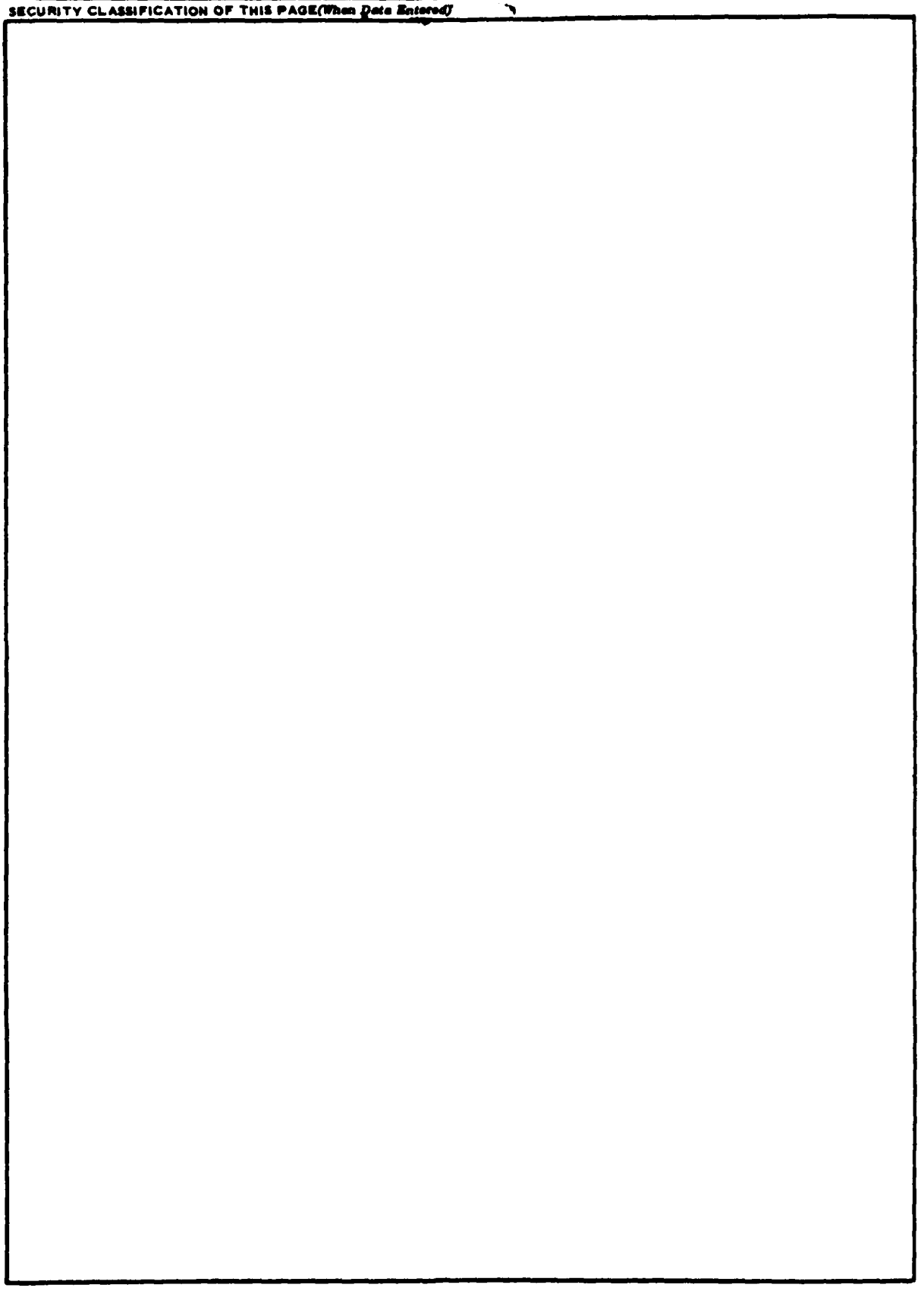

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Mo Noname 408 Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Mo Noname 408 Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

28 FEB 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

28 FEB 1979
Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
MO NONAME 408 DAM
MO 30580

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Mo Noname 408
State Located	Missouri
County Located	Osage County
Stream	Tributary to Pointers Creek
Date of Inspection	September 12, 1978

Mo Noname 408 dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends 1.5 miles downstream of the dam. Within the damage zone are three houses and associated farm buildings and two county roads. The floodplain is farmed.

Our inspection and evaluation indicates that in consideration of the small volume of water impounded, 50% of the Probable Maximum Flood is the appropriate design flood. The spillways of this dam meet this criteria. The spillways will pass the 100-year event as well as 50% of the Probable Maximum Flood (PMF) without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonable possible in the region.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These analyses should be obtained in the future.

Deficiencies visually observed by the inspection team were willow trees growing on the upstream slope, dead willows rooted below the water level on the upstream slope, trees (up to 8" diameter) and brush covering the downstream slope, rodent holes (up to 6" diameter) in the downstream slope, and seepage at the toe of the dam along each abutment.

Several items of preventive maintenance need to be initiated by the owner. These are described in detail in the body of the report.

Harold P. Hoskins, P.E.
Hoskins-Western-Sonderegger, Inc.
Lincoln, Nebraska

PHOTO NO. 1
OVERVIEW FROM
LEFT (EAST) SIDE

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
MO NONAME 408 LAKE DAM - MO 30580
OSAGE COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Mo Noname 408 dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

(1) The dam is an earth structure, oriented roughly east-west across a small drainageway. Topography at and around the site is rolling to moderately steep. Soils on the slopes consist of residual and colluvial materials developed from cherty limestone.

(2) The right spillway is a vegetated earth channel cut into the west abutment. On the left side there is a small training dike which serves to divert high reservoir levels around the left end of the dam and away from the dam-abutment trough. This training dike was purposely breached in 1967 or 1968 when the right spillway was operating.

(3) A one inch pipeline passes through the base of the dam near the mid point of the embankment centerline. This waterline is used for yard and garden irrigation and is controlled by a valve at the outlet end.

(4) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the east central portion of Osage County, Missouri, as shown on Plate 2. The dam and the lake formed by the dam are shown on Plate 1 in the NE 1/4 of Section 25, T43N, R8W, and the NW 1/4 of Section 30, T43N, R7W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the small size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends 1.5 miles downstream of the dam. Within the damage zone are three houses and associated farm buildings and two county roads. The floodplain is farmed.

e. Ownership. The dam is owned by Donald J. Rohlfing, No. 36 Oak Hill Road, St. Peters, Missouri 63376.

f. Purpose of Dam. The dam forms a 5 acre ± recreational lake.

g. Design and Construction History. No data were available on the design or construction of the dam. It was reported that the dam was construction in 1961 or 1962.

h. Normal Operating Procedure. Reservoir levels are controlled by natural forces. It was reported that a flow about 6 inches deep passed through the right spillway in 1967 or 1968. Water starts flowing through the breach in the left training dike and then will overtop the left training dike before reaching the crest of the right spillway. The reservoir level is normally about 2 feet below the crest of the dam. The reservoir was about 5 feet below the crest at the time of the inspection. During extended dry periods the reservoir level may drop 8 feet, or more, below the crest elevation.

1.3 PERTINENT DATA

a. Drainage Area - 93.5 acres.

b. Discharge at Damsite.

(1) The greatest volume of discharge at the dam is over the left training dike and through the breach made in the dike in 1967 or 1968. The remaining volume of discharge is through the uncontrolled grassed earth channel cut into the right abutment. A one-inch pipeline passes through the base of the dam.

(2) Estimated maximum flood at damsite - unknown.

(3) The primary spillway capacity varies from 0 c.f.s. at elevation (699.3) to 12 c.f.s. at the minimum elevation of the top of the dam (700.0).

(4) The capacity of flow over the training dike (secondary spillway) on the left end of the dam varies from 0 c.f.s. at elevation (697.1) to 708.6 c.f.s. at the minimum elevation of the top of the dam (700.0).

(5) The total spillway capacity at elevation (700.0) is 720.1 c.f.s.

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 700.8 ± (average) - 700.0 ± (minimum).

(2) Primary spillway crest - 699.3.

(3) Secondary spillway crest - 698.6 (average) - 697.1 (at breach).

(4) Streambed at centerline of dam - 678 ±.

(5) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 875 feet ±.

e. Storage (Acre-feet). Top of dam - 55.

f. Reservoir Surface (Acres).

(1) Top of dam - 6.3 acres ±.

(2) Secondary spillway crest - 5.7 acres ±.

g. Dam.

(1) Type - Earth embankment.

(2) Length - 600 ± feet.

(3) Height - 22 ± feet

(4) Top Width - 12 to 15 feet (measured).

(5) Side Slopes

(a) Downstream - 2H on 1V (measured).

(b) Upstream - 3H on 1V (measured on exposed slope).

(6) Zoning - unknown.

(7) Impervious Core - unknown.

(8) Cutoff - unknown.

(9) Grout curtain - unknown.

(10) Slope Protection - vegetation.

h. Diversion Channel and Regulating Tunnel. None

i. Spillways.

(1) Primary (Left side)

(a) Type - uncontrolled grassed earth training dike.

(b) Length of dike - 200 feet ±.

(c) Typical section of dike - 4 foot top width with 2:1 side slopes.

(d) A breach is located in dike approximately 150 feet left of the dam abutment. It is approximately 3 feet long and 1.5 feet deep.

(e) Downstream channel - no constructed channel.

(2) Secondary (Right side)

(a) Type - uncontrolled grassed earth channel.

(b) Control section - a parabolic channel approximately 50 feet maximum width. Channel crest is approximately 0.7 foot below the minimum elevation of the top of dam.

(c) Crest elevation - 699.3 M.S.L.

(d) Upstream channel - clear and well grassed.

(e) Downstream channel - clear and well grassed.

j. Regulating Outlets.

(1) Primary spillway - none.

(2) Secondary spillway - none.

(3) A one inch pipeline controlled by a valve at the outlet end passes through base of dam.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available.

2.2 CONSTRUCTION

No construction data were available. It was reportedly constructed in 1962 or 1963.

2.3 OPERATION

No data on the operation of the spillways were available. It was reported that both spillways operated in 1967 or 1968.

2.4 EVALUATION

a. Availability. No data were available.

b. Seepage and stability analysis. Seepage and stability analyses comparable to the requirements of the 'Recommended Guidelines for Safety Inspection of Dams' were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions and made a matter of record.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Mo Noname 408 dam was made on September 12, 1978. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska who made the inspection were: Rey Decker, Soil Mechanics and Geology; Garold Ulmer, Civil Engineer; Richard Walker and Gordon Jamison, Hydrology. Mr. Hudson, who lives just downstream from the dam, spent some time with the inspection team. Specific observations are discussed below.

b. Dam. Several small willows are growing on the upstream slope and a number of dead willows are rooted below the present reservoir level. No significant erosion was noted on the upstream face of the dam. The downstream slope is covered with brush and trees up to 8 inches in diameter. Several rodent holes, up to 6 inches in diameter (see Photo No. 10), were observed on the downstream slope. Soils on the surface of the embankment consist of lean clay (CL) to clayey silt (ML). No cracks, slides or abnormal deformations were noted in the embankment.

The abutments are covered with soil which probably overlays limestone bedrock. (Limestone is exposed in the road cut downstream from the left abutment of the dam.) No slides were noted in the abutments.

Evidence of seepage was observed along the downstream toe of the dam on both abutments. Seepage on the left abutment outcrops downstream from about ℄ Station 1+00 at about elevation 694 feet. Seepage on the right abutment outcrops about opposite ℄ Station 5+25 at about elevation 691 feet. There was no flow from these seepy areas at the time of the inspection. Mr. Hudson reported that both seep areas discharge flow until "the dry season comes".

c. Appurtenant Structures. The primary spillway is a small training dike on the left (east) end of the dam. The training dike was obviously constructed to divert surface runoff into the reservoir and away from the dam-abutment trough as well as to divert high reservoir levels around the left end of the dam-abutment trough. The secondary spillway consists of a parabolic channel cut through the soils in the right abutment. (See Appendix C.) At the centerline of the dam, the spillway has a maximum width of 50 feet ± and a maximum depth of 0.7 foot ± below the elevation of the top of dam. The inlet or forebay section extends about 50 feet upstream from the centerline of dam and control section. The exit section

extends along the downstream toe of the dam and outlets onto the floodplain east of and adjacent to Mr. Hudson's house. All sections of the secondary spillway are well vegetated and maintained. No obstructions were noted in the spillway. The average elevation of the left training dike is less than the crest elevation of the right spillway. Flood waters would flow over the training dike prior to flowing through the right spillway. The training dike was breached in 1967 or 1968 in order to reduce the flow in the right spillway which discharges along the toe of the dam adjacent to Mr. Hudson's house. The breach in the dike is about 3 feet wide and 1.5 feet deep. The elevation of the breach is 2.2 feet $\pm$ less than the crest of the right spillway.

d. Reservoir Area. No wave wash, excessive erosion or slides were noted along the shoreline.

e. Downstream Channel. One house and barn (Mr. Hudson) are located on the west side of the floodplain immediately below the dam. Discharge from the right spillway flows through Mr. Hudson's yard and under or over a gravel county road located about 300 feet downstream from the dam. No obstructions were noted in the channel downstream from the road. Mr. Hudson stated that his house has never sustained damage from flood waters. He also stated that the breach in the left training dike was made in order to decrease the flow through the right spillway, and that he periodically cleans out the breach. Water discharging from the left side does not cause him any problems. The potential does exist that heavy flows through the right spillway could cause damage to Mr. Hudson's house.

3.2 EVALUATION

None of the conditions observed are significant enough to indicate the need for immediate remedial action or serious potential of failure. Trees and brush on the embankment, large rodent holes on the downstream slope and seepage along the toe are deficiencies which, left uncontrolled or unanalyzed, could lead to potential of failure.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. (The one inch water supply line is not considered as an outlet system.) The pool level is controlled by rainfall, runoff, evaporation and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE

The secondary (right) spillway is well maintained. The left spillway is not an engineered structure. It should be reconstructed into one that is designed to convey an appropriate design discharge and should be maintained thereafter. Trees, shrubs, and rodent holes on the slopes indicate a lack of regular maintenance on the embankment.

4.3 MAINTENANCE AND OPERATING FACILITIES

There are no operating facilities at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

A potential of failure may result if deficiencies in maintaining the embankment are not corrected.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No original hydrologic design data were received from the owner.

b. Experience Data. The drainage area and lake surface area are developed from the USGS Linn N.E., Mo. (7½') Quadrangle. The spillway and dam layout are from surveys made during the inspection. No hydrologic or formal maintenance data have been kept. There is no evidence that the dam has ever been overtopped.

c. Visual Observations.

(1) The primary spillway or training dike extends approximately 200 feet ± east of the left abutment of the dam.

(2) The training dike has a breach in it located 150 feet ± left of the dam abutment. It is approximately 3 feet ± wide and 1.5 feet ± deep.

(3) The secondary spillway is located at the right abutment of the dam.

(4) The approach and exit channel of the secondary spillway are well grassed and clear of obstructions.

(5) The exit channel of the secondary spillway extends along the downstream toe of dam and outlets into floodplain east of and adjacent to Mr. Hudson's house.

(6) A one inch pipeline passes through the base of the dam near the midpoint of the embankment centerline. This is controlled by a valve at the outlet end.

(7) No drawdown facilities are available to evacuate the pool.

d. Overtopping Potential. The spillways are too small to pass the probable maximum flood without overtopping. The spillways will pass 50% of the PMF without overtopping. The existing spillways will pass the 100-year frequency flood without overtopping. The results of the routings through the dam are tabulated in regard to the following conditions.

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 700.0	Time Dam Overtopping Hr.
100 Yr.	200	200	699.1	+0.9	0
1/2 PMF	450	450	699.6	+0.4	0
PMF	900	900	700.2	-0.2	1 1/2

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. Therefore, the one-half PMF to the PMF is the test for the adequacy of the dam and its spillways.

The St. Louis District, Corps of Engineers, in a letter dated 11 August, 1978 has estimated the damage zone as extending 1.5 miles downstream of the dam. Within the damage zone are three houses and associated farm buildings and two county roads. The floodplain is farmed.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVAULATION OF STRUCTURAL STABILITY

a. Visual Observations. The side slopes measured on this dam should provide adequate factors of safety against shear failure for a dam of this height constructed with materials observed in the area. Visual observations of deficiencies which could adversely affect structural stability of this dam are discussed in Section 3. Briefly summarized, they include trees and shrubs on both slopes of the dam, rodent holes on the downstream slope and seeps along the toe of the dam on both abutments.

b. Design and Construction Data. No design or construction data are available.

c. Operating Records. There are no controlled operating structures for this dam. Additional studies would be required to assess the potential damage to the embankment that could result from overtopping.

d. Post Construction Changes. It was reported that the training dike on the left end of the dam was breached in 1967 or 1968 to reduce flow in the secondary spillway. This breach is about 150 feet from the end of the dam and should have no effect on the structural stability of the dam.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to cause a structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The structural stability of this dam from the standpoint of shear failures seems to be adequate. Additional studies would be required to assess the affects of seepage on structural stability when lake levels are higher than observed at the time of inspection.

The probable maximum flood will overtop the dam. The spillways will pass 50% of the probable maximum flood without overtopping.

The observed deficiencies in maintenance of the embankment (tree growth and rodent holes) could lead to potential of failure if not corrected.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report were based upon performance history and visual observation. The inspection team considers that these data are sufficient to support the conclusions herein. Neither seepage nor stability analysis were found which is a deficiency that should be corrected in the future.

c. Urgency. The remedial measures recommended in paragraph 7.2, below, should be accomplished in the near future, particularly those related to spillway operations. If the deficiencies in embankment maintenance discussed in paragraph "a" are not corrected, they could lead to potential of failure.

d. Necessity for Phase II. Phase II investigation is not considered necessary. However, additional engineering data should be obtained at the owner's expense relative to seepage analyses and prevention of overtopping.

e. Seismic Stability. An earthquake of the magnitude that can be expected in this area should not be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives.

(1) A spillway should be constructed on the left abutment. Spillway should have the capability of passing 50% of the probable maximum flood without overtopping the dam. The spillway should have a control section or sill and should also include the development of an approach section as well as a well defined downstream channel.

(2) The secondary spillway on the right abutment should be permanently plugged.

(3) Seepage and stability analyses should be performed.

(4) A professional engineer experienced in the design and construction of earth dams should be retained by the owner to perform the functions listed above.

b. O & M Maintenance and Procedures

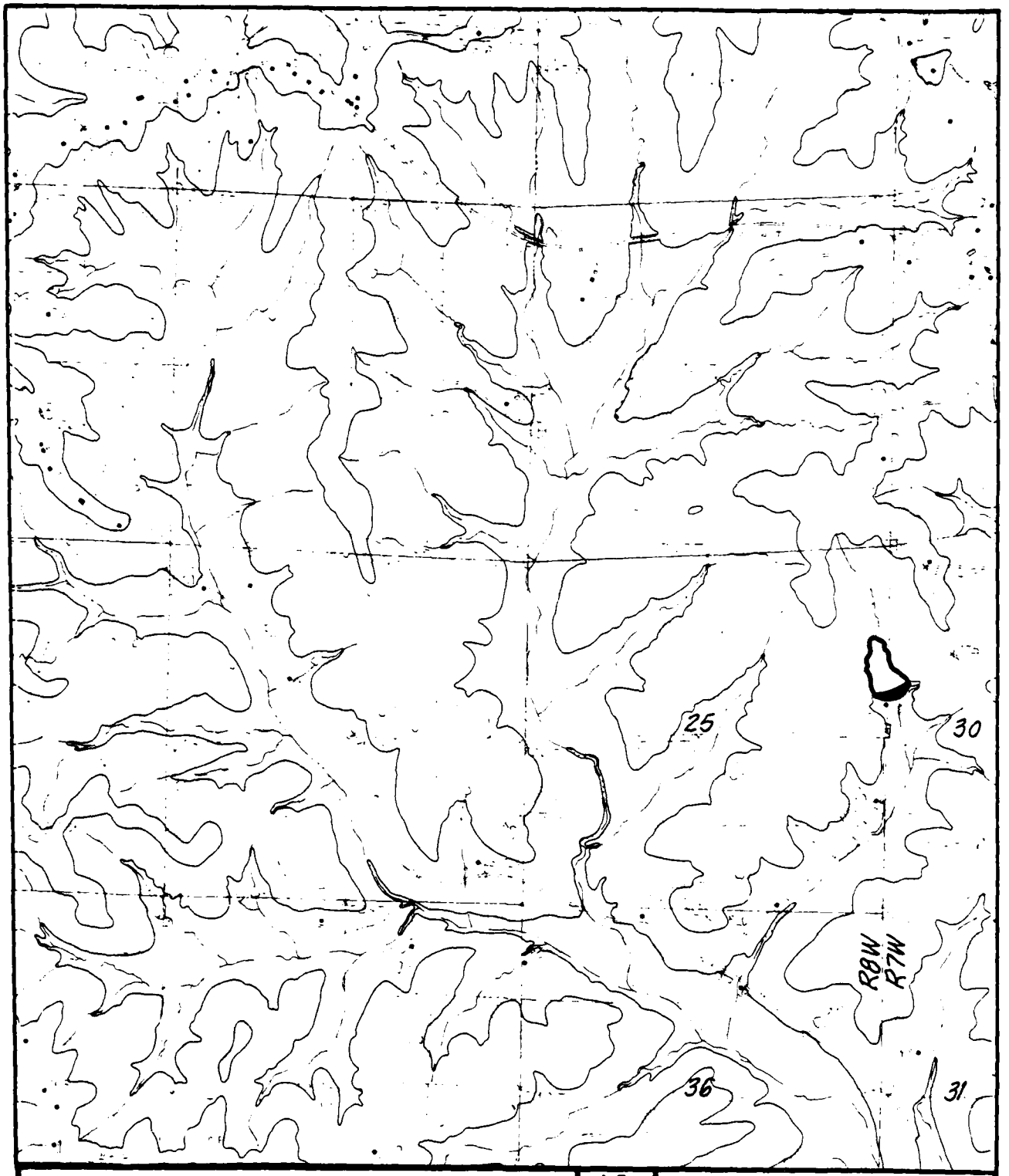
(1) Trees and brush should be removed from the embankment and maintenance measures initiated to prevent regrowth.

(2) All rodent holes should be repaired.

(3) Grass and weeds growing on embankment or in spillway should be mowed on a regular basis.

(4) The dam should be periodically inspected by an experienced professional engineer. The inspections should be designed to monitor earth slides, seepage, vegetative growth, rodent holes and erosion of spillway channel. The inspections should be followed by a preventative maintenance program that will cause repair to be done on a timely basis in order to protect the integrity of the dam.

APPENDIX A
MAPS



SCALE IN FEET
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1000 500 0 1000
SCALE IN METERS

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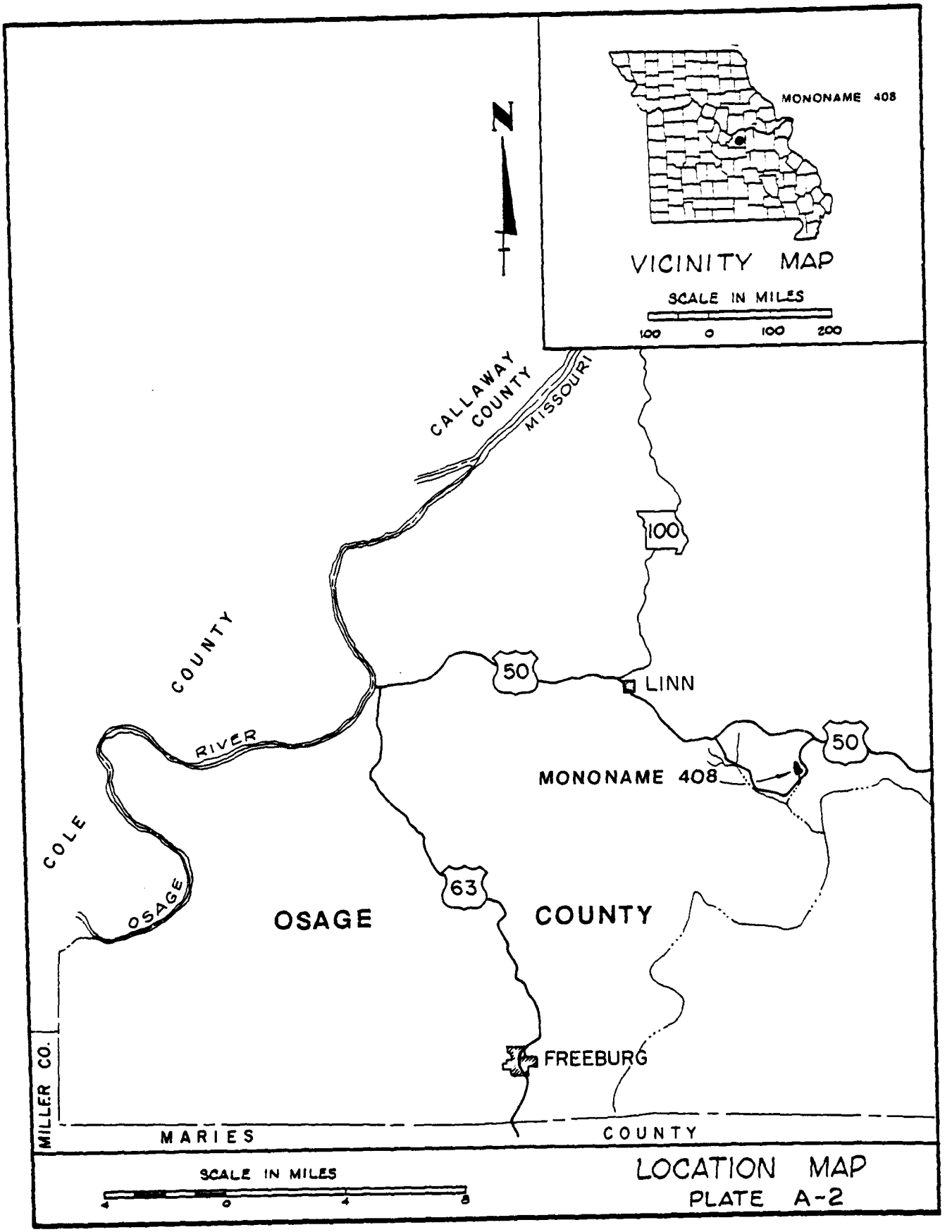
MONONAME 408

VICINITY TOPOGRAPHY

PLATE A-1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MONONAME 408
VICINITY MAP
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CALLAWAY COUNTY
MISSOURI
100
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LINN
50
MONONAME 408
COUNTY
RIVER
COLE
OSAGE
63
OSAGE
COUNTY
FREEBURG
MILLER CO.
MARIES
COUNTY
SCALE IN MILES
4 0 4 8
LOCATION MAP
PLATE A-2

APPENDIX B
PHOTOGRAPHS

PHOTO NO. 2
LOOKING EAST
FROM SOUTHEAST
CORNER OF LAKE

PHOTO NO. 3
LOOKING DOWNSTREAM
IN PRIMARY SPILLWAY
ON RIGHT ABUTMENT.
ROD ON CONTROL SECTION
AT CENTERLINE OF DAM.

PHOTO NO. 4
SEEP AT RIGHT (WEST)
END OF DAM NEAR TOE.
STATION 5+25±.

PLATE B-1

PHOTO NO. 5
LOOKING UPSTREAM FROM
CENTERLINE STATION 4+00±

PHOTO NO. 6
LOOKING DOWNSTREAM
IN RIGHT EMERGENCY
SPILLWAY EXIT CHANNEL

PHOTO NO. 7
LOOKING UPSTREAM
TOWARD EAST HALF
OF DAM.

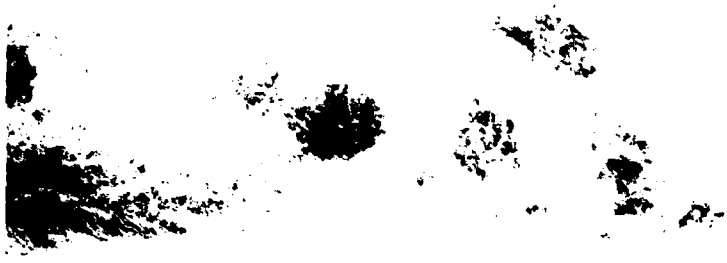


PHOTO NO. 8
LOOKING UPSTREAM
TOWARD WEST HALF
OF DAM.

PHOTO NO. 9
LOOKING UPSTREAM
FROM 200'± DOWNSTREAM
OF DAM. ROD AT STATION
3+25±.

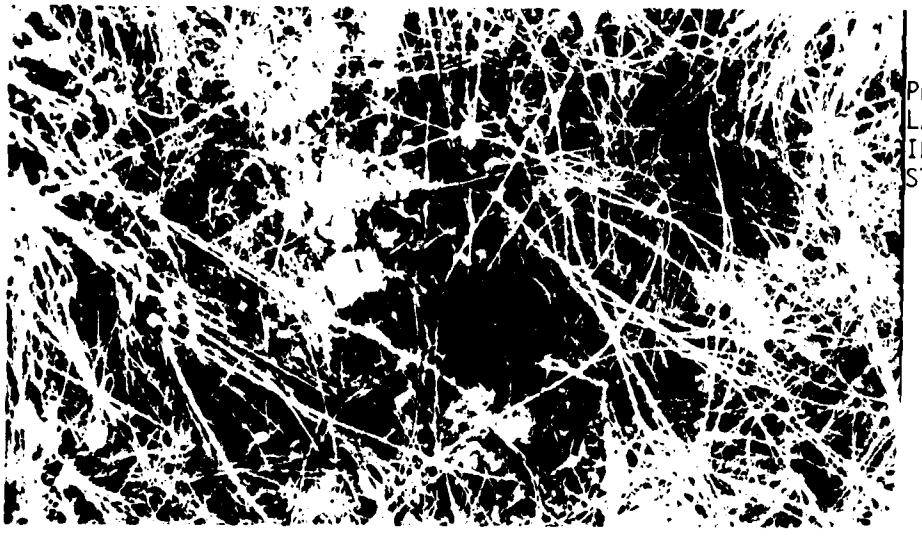


PHOTO NO. 10
LARGE RODENT HOLE
IN DOWNSTREAM SLOPE.
STATION 3+50±.

PLATE B-3

PHOTO NO. 11
DOWNSTREAM SLOPE
FROM CREST AT
LOCATION OF ONE
INCH WATER LINE.

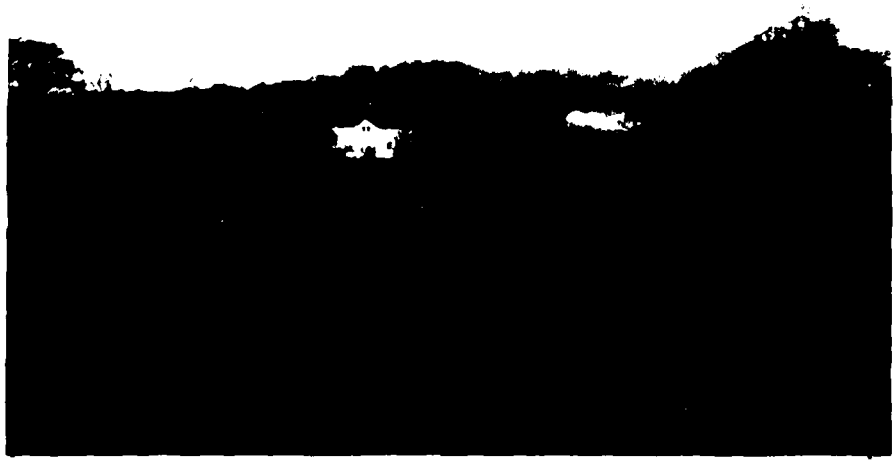


PHOTO NO. 12
DOWNSTREAM SLOPE
FROM LEFT (EAST) END.

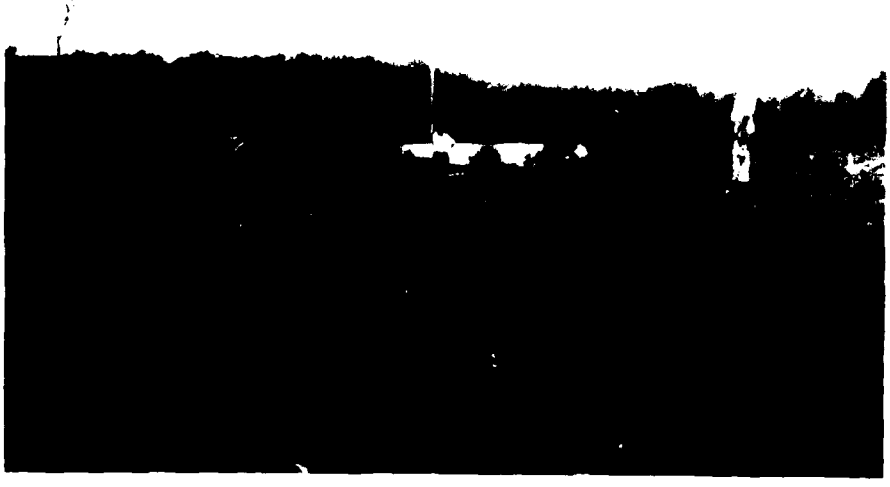


PHOTO NO. 13
LOOKING UPSTREAM
IN DIVERSION-SPILLWAY
CHANNEL ON LEFT (EAST)
ABUTMENT. DIVERSION
DIKE THAT WAS BREACHED
ON LEFT SIDE. ROD AT
CENTERLINE OF DAM.

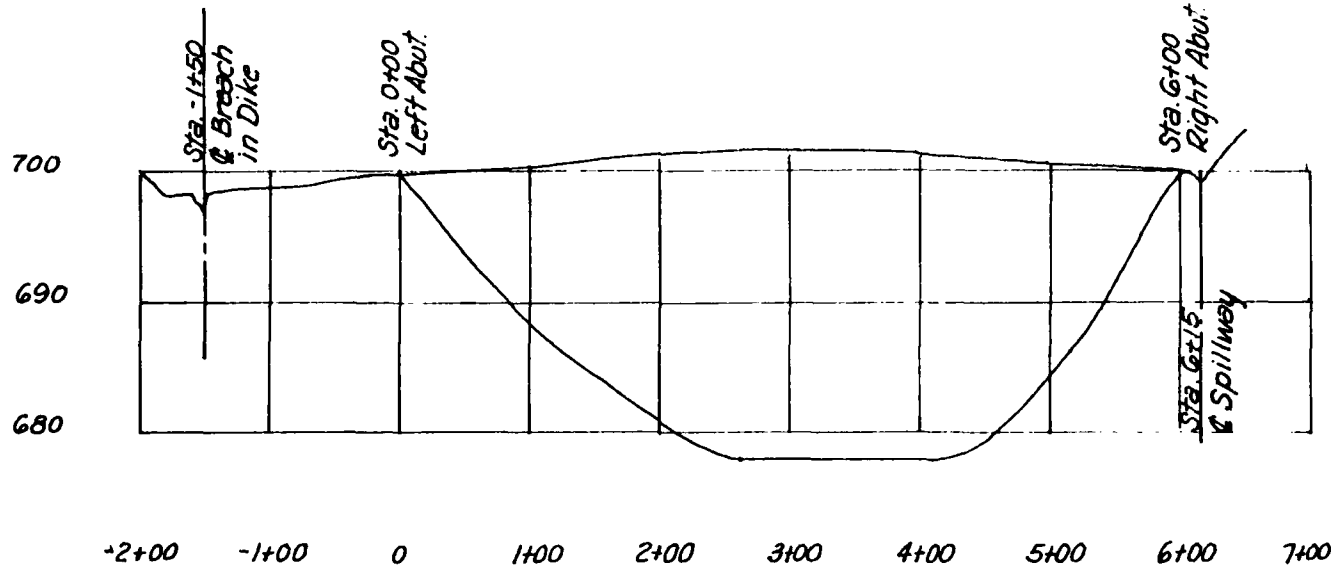
PLATE B-4

PHOTO NO. 14
OVERVIEW OF LEFT (EAST) END OF DAM SHOWING INLET FROM DIVERSION DIKE.

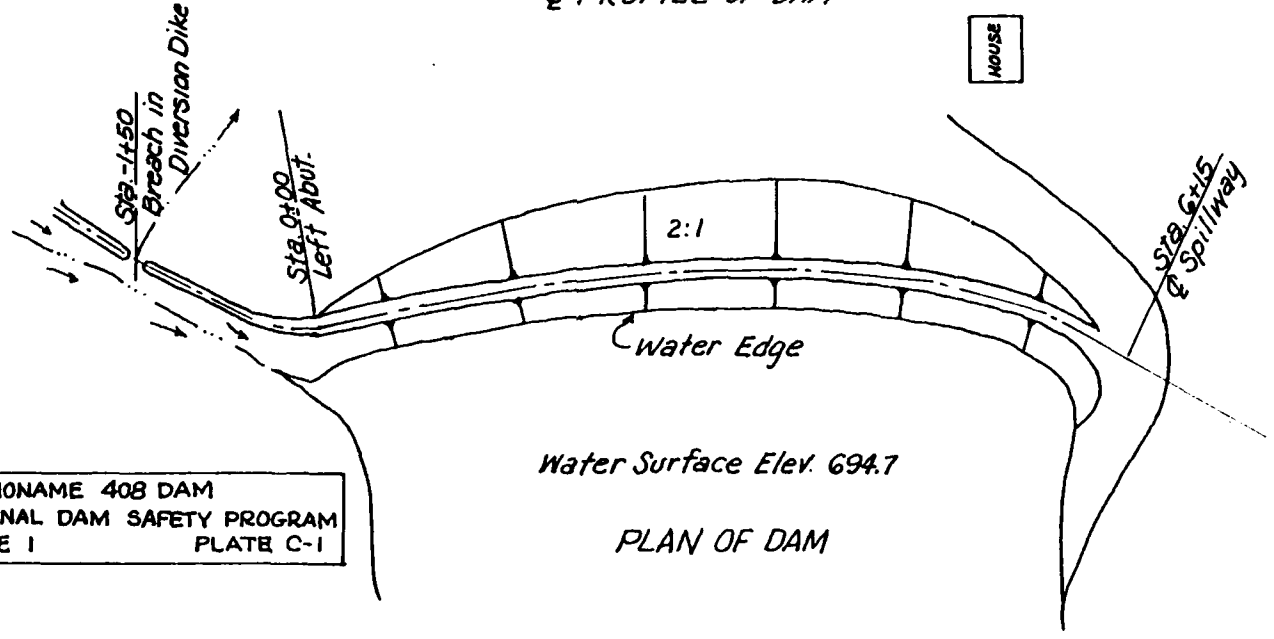
PHOTO NO. 15
CREST OF DAM TAKEN FROM EAST END.

PHOTO NO. 16
SEEPY SPOT AT DOWNSTREAM TOE ON LEFT (EAST) ABUTMENT. TAKEN LOOKING WEST.

APPENDIX C
PLAN, PROFILES & SECTION

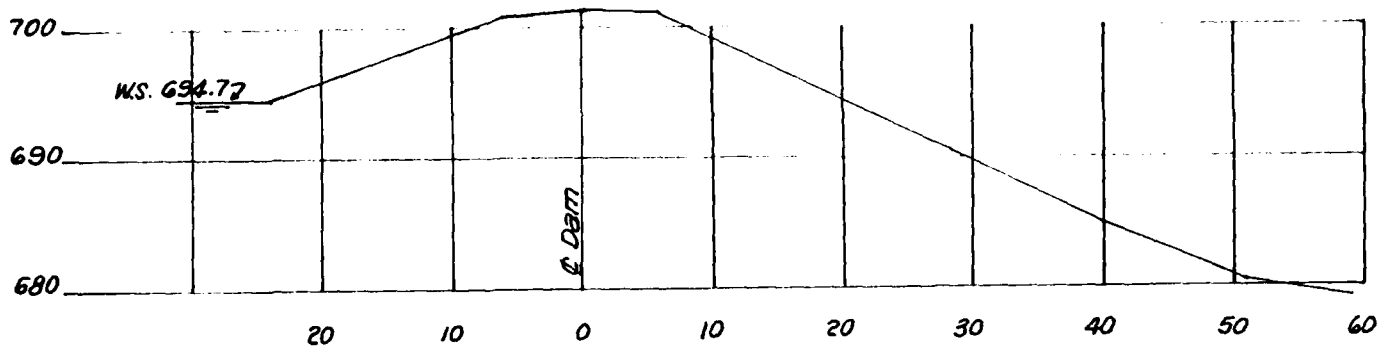


℄ PROFILE OF DAM

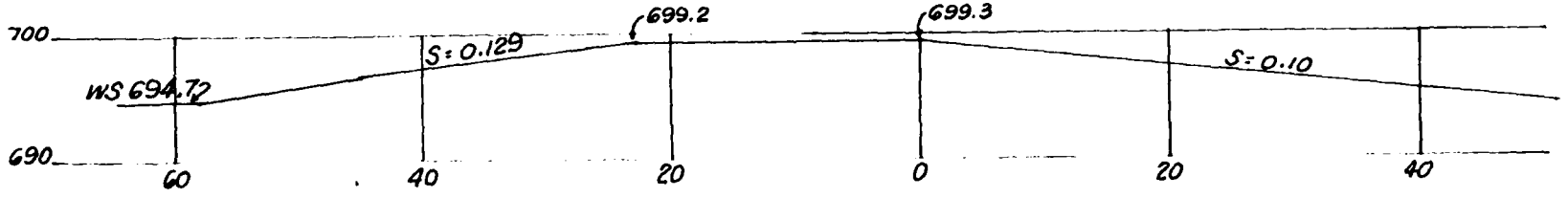


PLAN OF DAM

MO NONAME 408 DAM
NATIONAL DAM SAFETY PROGRAM
PHASE I PLATE C-1



CROSS SECTION - STA. 4+00



℄ PROFILE SPILLWAY

MO NONAME 408 DAM
NATIONAL DAM SAFETY PROGRAM
PHASE I PLATE C-2

APPENDIX D
HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Mockes dimensionless standard curvalinear unit hydrograph and the SCS TR-20 program were used to develop the inflow hydrographs (see Plate D1).

a. Twenty four-hour, 12-hour, and 6-hour 100-year rainfalls for the dam location were taken from NWS Technical Paper 40. The 24-hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current OCE directives furnished 4 August 1978 and formally stated in a letter dated 21 August 1978.

b. Drainage area = 0.15 square mile.

c. Time of concentration of runoff tc = 11 minutes. This is based on the Kirpich Formula. The effective duration ΔD used for application of the unit hydrograph to the rainfall distribution is computed as 0.171 tc by the TR-20 program.

d. The antecedent storm conditions were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMCIII). The initial pool elevation was assumed at the crest of the secondary spillway.

e. The total 24-hour storm duration losses (interception, infiltration and evapotranspiration) for the 100-year storm were 1.59 inches which is approximately a 0.22 PMF storm. The total losses for the 24-hour duration 1/2 PMF storm were 1.59 inches. The total losses for the PMF storm were 1.62 inches. These data are based on a determination of the SCS soil group to be a weighted combination of McGirk and Union soil groups both in SCS hydrologic soil group C. The resultant SCS runoff curve number, based on fair farm weedlot type vegetation cover is 87 and antecedent moisture conditions from SCS AMCIII.

f. Average soil loss rates = 0.05 inch per hour approximately.

2. A combined spillway discharge and dam overtopping rating was computed from the given field data. The primary discharge ratings were developed using the concept of critical depth in the spillway control section and conservative head losses through the spillway entrance section (head loss = 0.25 Hv), where Hv is the velocity head at the spillway control section. The flows over the dam crest and the secondary spillway or training dike are based on the broad crested weir equation ($Q = CLH^{3/2}$), where H is the head on the dam crest and dike crest; L is the effective weir length; the coefficient C, which varies with head, is based on USGS criteria for road or dam embankments with an unpaved surface. The one inch pipeline was not included in the hydrologic computations.

3. Floods were routed through the spillway using the TR-20 program, which uses the "modified puls" method to determine capability of the spillway and dam embankment crest. The storm rainfall patterns, inflow hydrographs and routed outflow hydrographs are given on Plate D1. Given thereafter are reproductions of the TR-20 input and output sheets. The output and input parameters and data are defined in SCS Technical Release No. 20 1965.

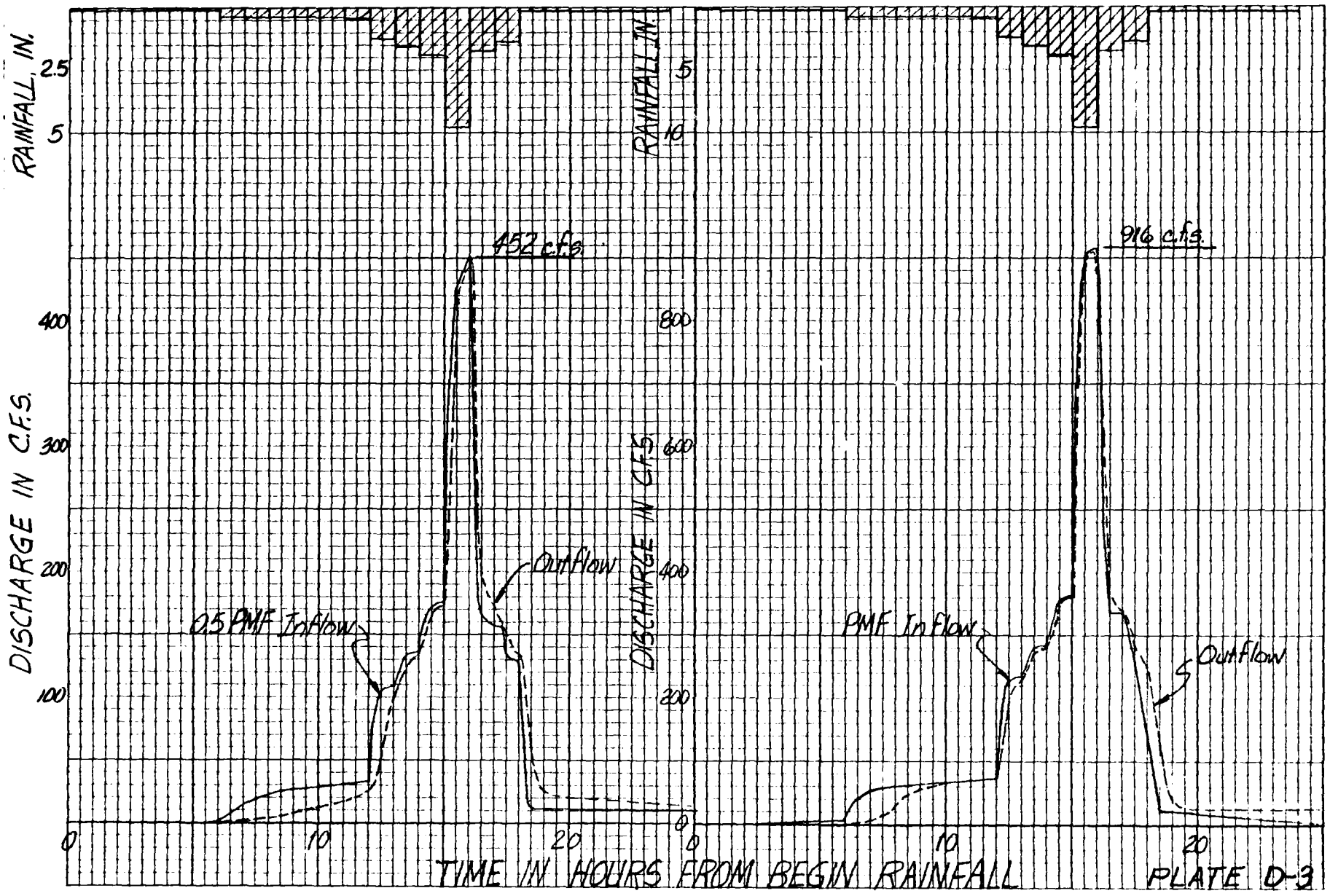

RAINFALL, IN.
2.5
5
DISCHARGE IN C.F.S.
400
300
200
100
0
452 c.f.s.
0.5 PMF Inflow
Outflow
10
20
RAINFALL IN.
5
10
DISCHARGE IN C.F.S.
800
600
400
200
0
916 c.f.s.
PMF Inflow
Outflow
10
20
TIME IN HOURS FROM BEGIN RAINFALL

PLATE D-3

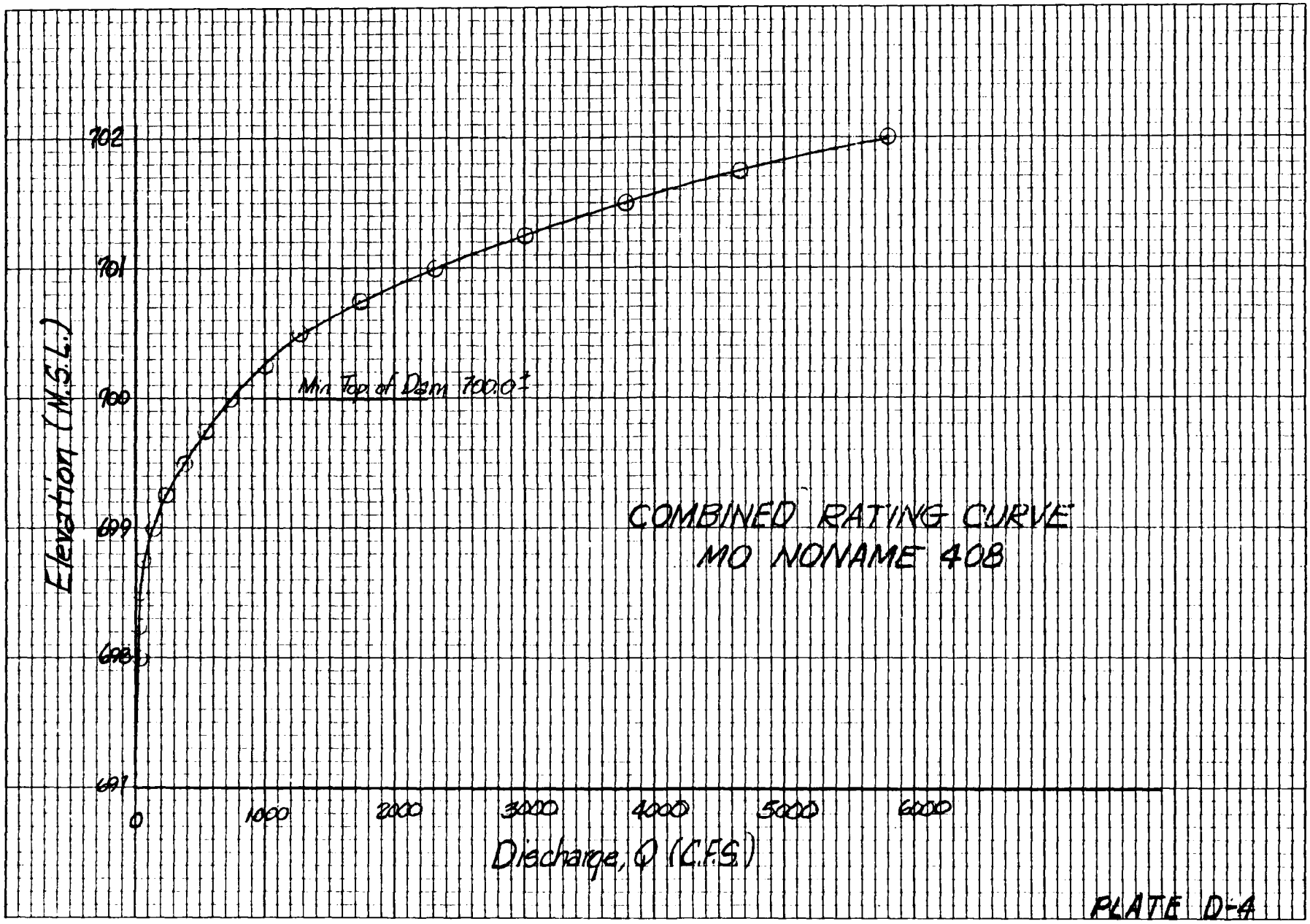

702
701
700
699
698
697
Elevation (M.S.L.)
Min Top of Dam 700.0'
0
1000
2000
3000
4000
5000
6000
Discharge, Q (C.F.S.)
COMBINED RATING CURVE
MO NONAME 408

PLATE D-4

SKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR 30586

COMPUTED BY GGU DATE 10/5/78 SHEET NO. 13 OF

CHECKED BY DATE JOB NUMBER 78/3095

PROJECT Mo. Dam Insp

Combined Rating Curve

Elevation	Discharge over embankments	Discharge Thru Spillway	Total Discharge	Storage Volume
697.1	0	0	0	38.70
698.0	12.0		12.0	43.4
698.25	17.6		17.6	44.8
698.50	27.2		27.2	46.2
698.75	63.8		63.8	47.6
699	131.6		131.6	49.0
699.25	225.5		225.5	50.5
699.50	366.1	3.0	369.1	52.0
699.75	522.3	6.7	529.0	53.5
700	708.6	11.5	720.1	55.0
700.25	979.5	24.0	1003.5	56.6
700.50	1254.3	30.8	1285.1	58.2
700.75	1664.6	69.6	1734.2	59.8
701	2203.7	103.3	2307	61.5
701.25	2922.8	120.0	3042.8	63.1
701.50	3575.8	218.2	3794	64.8
701.75	4420.6	255.6	4676.2	66.6
702.00	5468.2	328.1	5796.3	68.3

PLATE D-5

HYDROLOGY PROGRAM FOR IBM 1130 - DATED JULY, 1968

MO DAM INSPECTION-MONONAME 408-LINN, MO. TR-20 ROUTING.

EXECUTIVE CONTROL CARD OPERATION LIST

MO DAM INSPECTION-MONONAME 408-LINN, MO.

C TABLE VELOCITY INCREMENT = 0.200

8	0.0000	0.0800	0.1800	0.2500	0.3200
8	0.3700	0.4100	0.4500	0.4900	0.5100
8	0.5400	0.5700	0.5900	0.6100	0.6300
8	0.6500	0.6600	0.6700	0.6900	0.7000
8	0.7100	0.7200	0.7300	0.7400	0.7500
8	0.7600	0.7700	0.7700	0.7800	0.7900
8	0.7900	0.8000	0.8100	0.8100	0.8200
8	0.8200	0.8300	0.8300	0.8400	0.8400
8	0.8400	0.8500	0.8500	0.8600	0.8600
8	0.8600	0.8600	0.8700	0.8700	0.8700
8	0.8800	0.8800	0.8800	0.8900	0.8900
8	0.8900	0.8900	0.8900	0.8900	0.9000
8	0.9000	0.9000	0.9000	0.9000	0.9100
8	0.9100	0.9100	0.9100	0.9100	0.9100
8	0.9200	0.9200	0.9200	0.9200	0.9200
8	0.9200	0.9200	0.9200	0.9300	0.9300
9 ENDTBL					

PMF & 0.5 PMF Routing

STRUCTURE NO. 1

	ELEVATION	DISCHARGE	STORAGE
8	697.1000	0.0000	38.6999
8	698.0001	12.0000	43.3999
8	698.2501	17.6000	44.7999
8	698.5001	27.2000	46.1999
8	698.7501	63.8000	47.5999
8	699.0001	131.6000	49.0000
8	699.2501	225.5000	50.4999
8	699.5001	369.1000	52.0000
8	699.7501	529.0001	53.5000
8	700.0001	720.1000	55.0000
8	700.2501	1003.5001	56.5999
8	700.5001	1285.1001	58.1999
8	700.7501	1734.2001	59.7999
8	701.0001	2307.0004	61.5000
8	701.2501	3042.8002	63.0999
8	701.5001	3794.0004	64.7999
8	701.7501	4676.2002	66.5999
8	702.0001	5796.3007	68.2999
9 ENDTBL			

DIMENSIONLESS HYDROGRAPH - DELTA T =484.00

8	0.0000	0.0300	0.1000	0.1900	0.3100
8	0.4700	0.6600	0.8200	0.9300	0.9900
8	1.0000	0.9900	0.9300	0.8600	0.7800
8	0.6800	0.5600	0.4600	0.3900	0.3300
8	0.2800	0.2410	0.2070	0.1740	0.1470
8	0.1260	0.1070	0.0910	0.0770	0.0660
8	0.0550	0.0470	0.0400	0.0340	0.0290
8	0.0250	0.0210	0.0180	0.0150	0.0130
8	0.0110	0.0090	0.0080	0.0070	0.0060
8	0.0050	0.0040	0.0030	0.0020	0.0010
8	0.0000	0.0000	0.0000	0.0000	0.0000
9 ENDTBL					

RAINFALL TABLE NO. 1 TIME INCREMENT = 0.50

8	0.0000	0.0080	0.0170	0.0260	0.0350
8	0.0450	0.0550	0.0650	0.0760	0.0870
8	0.0990	0.1120	0.1250	0.1400	0.1560
8	0.1740	0.1940	0.2190	0.2540	0.3030
8	0.5150	0.5830	0.6240	0.6540	0.6820
8	0.7050	0.7270	0.7480	0.7670	0.7840
8	0.8000	0.8160	0.8300	0.8440	0.8570
8	0.8700	0.8820	0.8930	0.9050	0.9160
8	0.9260	0.9360	0.9460	0.9550	0.9650
8	0.9740	0.9830	0.9920	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 2 TIME INCREMENT = 0.02

PLATE D-6

```
8                0.0000    0.0100    0.0200    0.0200    0.0300
8                0.0400    0.0500    0.0600    0.0700    0.0800
8                0.1000    0.1100    0.1300    0.1400    0.1700
8                0.1900    0.2200    0.2700    0.3500    0.4400
8                0.5200    0.6000    0.6300    0.6600    0.6800
8                0.7000    0.7200    0.7400    0.7600    0.7700
8                0.7900    0.8000    0.8200    0.8300    0.8400
8                0.8500    0.8700    0.8800    0.8900    0.9000
8                0.9100    0.9200    0.9300    0.9400    0.9500
8                0.9567    0.9633    0.9700    0.9800    0.9900
8                1.0000    1.0000    1.0000    1.0000    1.0000
9 ENDTBL
```

RAINFALL TABLE NO. 3 TIME INCREMENT = 0.50

```
8                0.0000    0.0700    0.1400    0.2100    0.2900
8                0.3600    0.4400    0.5100    0.5900    0.6600
8                0.7400    0.8100    0.8900    1.2800    1.6800
8                2.0700    2.4700    2.8600    3.2600    3.6500
8                4.0500    4.4400    4.8400    5.2400    5.6400
8                6.9100    8.1900    9.7200   11.2500   13.1600
8               15.0800   19.9200   24.7700   26.5500   28.3400
8               29.7400   31.1400   31.2500   31.3700   31.4800
8               31.6000   31.7100   31.8300   31.9400   32.0600
8               32.1700   32.2800   32.3900   32.5000   32.5000
9 ENDTBL
```

PLATE D-7

STANDARD CONTROL INSTRUCTIONS

SUBRTN	XSECTN	STRCT	HYDROGRAPHS IN1	IN2	OUT	DATA NO. 1	DATA NO. 2	DATA NO. 3	OUTPUT OPTIONS PK	H	E	V	PH	SM
RUNOFF	0	1	0	0	6	0.146	73.000	0.190	1	1	0	1	0	0
RESVOR	0	1	6	0	7	697.100	0.000	0.000	1	1	1	1	0	0
ENDATA														

END OF LISTING

PLATE D-8

EXECUTIVE CONTROL CARD OPERATION INCREM. MAIN TIME INCREMENT= 0.15
EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

PMF Computations

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.14 INPUT RUNOFF CURVE= 73.0 TIME OF CONCENTRATION= 0.19
COMPUTED CURVE NO. = 86.8

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
4.07	4.154	(RUNOFF)
5.03	5.686	(RUNOFF)
8.14	61.781	(RUNOFF)
9.00	66.141	(RUNOFF)
10.00	68.761	(RUNOFF)
15.02	915.550	(RUNOFF)
16.07	339.052	(RUNOFF)

HYDROGRAPH, TZERO= 2.54 DELTA T= 0.15 DRAINAGE AREA= 0.14

Input Hydrograph

TIME											
2.54	DISCHG	0.00	1.16	1.58	1.98	2.17	2.36	2.61	2.99	3.53	3.86
4.05	DISCHG	4.14	4.02	4.13	4.32	4.90	5.37	5.64	5.65	5.41	5.50
5.55	DISCHG	5.71	6.46	6.81	7.15	23.91	37.23	42.07	45.56	48.85	51.26
7.05	DISCHG	53.18	53.97	55.21	56.50	58.53	60.18	61.27	61.73	61.62	62.17
8.55	DISCHG	62.92	64.66	65.54	66.11	65.66	65.48	65.79	66.64	67.98	68.49
10.05	DISCHG	68.70	67.79	67.71	67.91	69.12	69.98	70.29	70.50	70.69	70.87
11.55	DISCHG	71.03	71.19	71.34	72.51	168.31	216.27	228.17	230.96	232.85	233.72
13.05	DISCHG	237.88	270.24	279.89	281.83	282.52	282.96	283.36	304.47	345.91	353.79
14.55	DISCHG	355.44	357.17	357.83	361.63	667.14	868.73	900.69	906.83	908.72	909.44
16.05	DISCHG	865.20	468.48	353.67	336.61	335.24	335.97	336.12	314.75	271.94	264.26

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 27.1831 CFS-HRS= 2561.30 ACRE-FT= 211.66

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 697.10

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
10.24	67.907	698.76
15.03	912.499	700.16

HYDROGRAPH, TZERO= 2.54 DELTA T= 0.15 DRAINAGE AREA= 0.14

Output Hydrograph

TIME											
2.54	DISCHG	0.00	0.01	0.06	0.11	0.17	0.24	0.31	0.38	0.47	0.57
2.54	ELEV	697.10	697.10	697.10	697.10	697.11	697.11	697.12	697.12	697.13	697.14
4.05	DISCHG	0.68	0.79	0.89	0.99	1.11	1.23	1.36	1.50	1.62	1.74
4.05	ELEV	697.15	697.15	697.16	697.17	697.18	697.19	697.20	697.21	697.22	697.23
5.55	DISCHG	1.86	2.00	2.14	2.29	2.70	3.57	4.70	5.91	7.20	8.54
5.55	ELEV	697.24	697.25	697.26	697.27	697.30	697.36	697.45	697.54	697.64	697.74
7.05	DISCHG	9.90	11.26	12.95	15.02	17.08	20.17	23.48	26.58	34.88	42.41
7.05	ELEV	697.84	697.94	698.04	698.13	698.22	698.31	698.40	698.48	698.55	698.60
8.55	DISCHG	48.03	52.42	55.96	58.71	60.71	62.07	63.06	64.04	65.55	66.79
8.55	ELEV	698.64	698.67	698.69	698.71	698.72	698.73	698.74	698.75	698.75	698.76
10.05	DISCHG	67.63	67.91	67.84	67.82	68.14	68.79	69.41	69.86	70.20	70.47
10.05	ELEV	698.76	698.76	698.76	698.76	698.76	698.76	698.77	698.77	698.77	698.77
11.55	DISCHG	70.69	70.88	71.06	71.46	92.22	138.19	185.73	210.24	222.35	229.45
11.55	ELEV	698.77	698.77	698.77	698.77	698.85	699.01	699.14	699.20	699.24	699.25
13.05	DISCHG	234.18	248.99	268.41	277.68	281.03	282.30	282.94	291.11	316.50	341.34
13.05	ELEV	699.26	699.29	699.32	699.34	699.34	699.34	699.35	699.36	699.40	699.45
14.55	DISCHG	351.23	355.01	356.86	359.07	482.05	730.91	891.89	904.32	907.94	909.13
14.55	ELEV	699.46	699.47	699.47	699.48	699.67	700.00	700.15	700.16	700.16	700.16
16.05	DISCHG	886.30	666.55	449.74	366.67	343.77	337.69	336.46	328.25	302.25	276.81
16.05	ELEV	700.14	699.93	699.62	699.49	699.45	699.44	699.44	699.42	699.38	699.33

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 25.6882 CFS-HRS= 2420.44 ACRE-FT= 200.02

ENDCMP 1

PLATE D-9

EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 0.50 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

0.50 PMF Computations

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.14 INPUT RUNOFF CURVE= 75.0 TIME OF CONCENTRATION= 0.19
COMPUTED CURVE NO. = 86.8

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
10.06	29.129	(RUNOFF)
15.83	451.767	(RUNOFF)
16.87	168.210	(RUNOFF)
17.78	130.968	(RUNOFF)
18.92	11.214	(RUNOFF)
19.89	11.240	(RUNOFF)

HYDROGRAPH, TZERO= 5.69 DELTA T= 0.15 DRAINAGE AREA= 0.14

TIME											
5.69	DISCHG	0.00	1.03	1.15	4.34	7.71	9.78	11.60	13.36	14.86	16.17
7.19	DISCHG	17.07	18.06	19.04	20.24	21.30	22.15	22.73	23.08	23.64	24.26
8.70	DISCHG	25.25	25.91	26.42	26.51	26.69	27.04	27.62	28.39	28.81	29.10
10.20	DISCHG	28.89	29.03	29.20	29.95	30.48	30.76	30.99	31.21	31.41	31.61
11.70	DISCHG	31.80	31.98	32.61	72.52	99.44	104.72	106.74	108.28	109.28	111.78
13.20	DISCHG	127.59	132.73	134.19	135.01	135.65	136.23	146.79	167.21	171.45	172.64
14.70	DISCHG	173.84	174.48	176.73	326.61	426.35	443.10	447.03	448.72	449.71	428.32
16.20	DISCHG	232.07	175.29	166.89	166.27	166.68	166.80	156.23	135.01	131.22	130.67
17.70	DISCHG	130.64	130.67	129.96	62.67	18.16	11.36	10.57	11.09	11.19	11.15
19.20	DISCHG	10.49	10.30	10.28	10.80	11.14	11.19	10.93	10.38	10.29	10.34

Input Hydrograph

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 14.1914 CFS-HRS= 1337.17 ACRE-FT= 110.50

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 697.10

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.86	448.297	699.62

HYDROGRAPH, TZERO= 5.69 DELTA T= 0.15 DRAINAGE AREA= 0.14

TIME											
5.69	DISCHG	0.00	0.01	0.04	0.13	0.31	0.57	0.89	1.25	1.65	2.08
5.69	ELEV	697.10	697.10	697.10	697.11	697.12	697.14	697.16	697.19	697.22	697.25
7.19	DISCHG	2.54	3.01	3.49	3.99	4.52	5.05	5.59	6.13	6.67	7.21
7.19	ELEV	697.29	697.32	697.36	697.39	697.43	697.47	697.51	697.56	697.60	697.64
8.70	DISCHG	7.75	8.31	8.87	9.41	9.95	10.48	11.00	11.53	12.10	12.92
8.70	ELEV	697.68	697.72	697.76	697.80	697.84	697.88	697.92	697.96	698.00	698.04
10.20	DISCHG	13.70	14.43	15.15	15.85	16.54	17.22	18.08	19.14	20.13	21.06
10.20	ELEV	698.07	698.10	698.14	698.17	698.20	698.23	698.26	698.29	698.31	698.34
11.70	DISCHG	21.93	22.74	23.52	25.89	39.49	56.94	74.98	90.00	98.67	104.15
11.70	ELEV	698.36	698.38	698.40	698.46	698.58	698.70	698.79	698.84	698.87	698.89
13.20	DISCHG	111.32	120.02	126.23	130.09	132.70	134.52	138.43	148.81	160.28	166.86
13.20	ELEV	698.92	698.95	698.98	698.99	699.00	699.00	699.01	699.04	699.07	699.09
14.70	DISCHG	170.42	172.51	174.24	217.53	333.27	411.55	438.22	445.90	448.54	440.96
14.70	ELEV	699.10	699.10	699.11	699.22	699.43	699.56	699.60	699.62	699.62	699.61
16.20	DISCHG	353.86	242.00	198.24	180.54	172.68	169.36	164.97	154.15	142.39	135.99
16.20	ELEV	699.47	699.27	699.17	699.13	699.10	699.10	699.08	699.06	699.02	699.01
17.70	DISCHG	133.01	131.69	131.04	115.01	80.56	55.57	43.13	34.12	27.71	26.00
17.70	ELEV	699.00	699.00	698.99	698.93	698.81	698.69	698.60	698.54	698.50	698.46
19.20	DISCHG	24.76	23.59	22.50	21.53	20.67	19.89	19.17	18.48	17.81	17.36
19.20	ELEV	698.43	698.40	698.37	698.35	698.33	698.30	698.29	698.27	698.25	698.23

Output Hydrograph

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 13.3662 CFS-HRS= 1259.42 ACRE-FT= 104.07

ENDCMP 1

END OF JOB TR20 RHW
BATCH JOB

JOB NUMBER 78/3095 PHASE 0

PLATE D-10

HYDROLOGY PROGRAM FOR IBM 1130 - DATED JULY, 1968

MO DAM INSPECTION-MONONAME 408-LINN, MO. TR-20 ROUTING.

EXECUTIVE CONTROL CARD OPERATION LIST

MO DAM INSPECTION-MONONAME 408-LINN, MO.

C TABLE VELOCITY INCREMENT = 0.200

8	0.0000	0.0800	0.1800	0.2500	0.3200
8	0.3700	0.4100	0.4500	0.4900	0.5100
8	0.5400	0.5700	0.5900	0.6100	0.6300
8	0.6500	0.6600	0.6700	0.6900	0.7000
8	0.7100	0.7200	0.7300	0.7400	0.7500
8	0.7600	0.7700	0.7700	0.7800	0.7900
8	0.7900	0.8000	0.8100	0.8100	0.8200
8	0.8200	0.8300	0.8300	0.8400	0.8400
8	0.8400	0.8500	0.8500	0.8600	0.8600
8	0.8600	0.8600	0.8700	0.8700	0.8700
8	0.8800	0.8800	0.8800	0.8900	0.8900
8	0.8900	0.8900	0.8900	0.8900	0.9000
8	0.9000	0.9000	0.9000	0.9000	0.9100
8	0.9100	0.9100	0.9100	0.9100	0.9100
8	0.9200	0.9200	0.9200	0.9200	0.9200
8	0.9200	0.9200	0.9200	0.9300	0.9300
9 ENDTBL					

100 Year Routing

STRUCTURE NO. 1

	ELEVATION	DISCHARGE	STORAGE
8	697.1000	0.0000	38.6999
8	698.0001	12.0000	43.3999
8	698.2501	17.6000	44.7999
8	698.5001	27.2000	46.1999
8	698.7501	63.8000	47.5999
8	699.0001	131.6000	49.0000
8	699.2501	225.5000	50.4999
8	699.5001	369.1000	52.0000
8	699.7501	529.0001	53.5000
8	700.0001	720.1000	55.0000
8	700.2501	1003.5001	56.5999
8	700.5001	1285.1001	58.1999
8	700.7501	1734.2001	59.7999
8	701.0001	2307.0004	61.5000
8	701.2501	3042.8002	63.0999
8	701.5001	3794.0004	64.7999
8	701.7501	4676.2002	66.5999
8	702.0001	5796.3007	68.2999
9 ENDTBL			

DIMENSIONLESS HYDROGRAPH - DELTA T =484.00

8	0.0000	0.0300	0.1000	0.1900	0.3100
8	0.4700	0.6600	0.8200	0.9300	0.9900
8	1.0000	0.9900	0.9300	0.8600	0.7800
8	0.6800	0.5600	0.4600	0.3900	0.3300
8	0.2800	0.2410	0.2070	0.1740	0.1470
8	0.1260	0.1070	0.0910	0.0770	0.0660
8	0.0550	0.0470	0.0400	0.0340	0.0290
8	0.0250	0.0210	0.0180	0.0150	0.0130
8	0.0110	0.0090	0.0080	0.0070	0.0060
8	0.0050	0.0040	0.0030	0.0020	0.0010
8	0.0000	0.0000	0.0000	0.0000	0.0000
9 ENDTBL					

RAINFALL TABLE NO. 1 TIME INCREMENT = 0.50

8	0.0000	0.0080	0.0170	0.0260	0.0350
8	0.0450	0.0550	0.0650	0.0760	0.0870
8	0.0990	0.1120	0.1250	0.1400	0.1560
8	0.1740	0.1940	0.2190	0.2540	0.3030
8	0.5150	0.5830	0.6240	0.6540	0.6820
8	0.7050	0.7270	0.7480	0.7670	0.7840
8	0.8000	0.8160	0.8300	0.8440	0.8570
8	0.8700	0.8820	0.8930	0.9050	0.9160
8	0.9260	0.9360	0.9460	0.9550	0.9650
8	0.9740	0.9830	0.9920	1.0000	1.0000
9 ENDTBL					

PLATE D-11

RAINFALL TABLE NO. 2 TIME INCREMENT = 0.02

8	0.0000	0.0100	0.0200	0.0200	0.0300
8	0.0400	0.0500	0.0600	0.0700	0.0800
8	0.1000	0.1100	0.1300	0.1400	0.1700
8	0.1900	0.2200	0.2700	0.3500	0.4400
8	0.5200	0.6000	0.6300	0.6600	0.6800
8	0.7000	0.7200	0.7400	0.7600	0.7700
8	0.7900	0.8000	0.8200	0.8300	0.8400
8	0.8500	0.8700	0.8800	0.8900	0.9000
8	0.9100	0.9200	0.9300	0.9400	0.9500
8	0.9567	0.9633	0.9700	0.9800	0.9900
8	1.0000	1.0000	1.0000	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 3 TIME INCREMENT = 0.50

8	0.0000	0.0300	0.0600	0.0900	0.1200
8	0.1500	0.1800	0.2100	0.2400	0.2700
8	0.3000	0.3300	0.3600	0.4400	0.5200
8	0.6000	0.6800	0.7600	0.8500	0.9300
8	1.0200	1.1000	1.1900	1.2700	1.3600
8	1.6300	1.9000	2.2200	2.5500	2.9500
8	3.3600	4.3800	5.4100	5.7900	6.1700
8	6.4600	6.7600	6.8000	6.8500	6.8900
8	6.9400	6.9800	7.0300	7.0700	7.1200
8	7.1600	7.2100	7.2500	7.3000	7.3000
9 ENDTBL					

PLATE D-12

STANDARD CONTROL INSTRUCTIONS

SUBRTN	XSECTN	STRCT	HYDROGRAPHS IN1	IN2	OUT	DATA NO. 1	DATA NO. 2	DATA NO. 3	OUTPUT OPTIONS PK	H	E	V	PH	SM
RUNOFF	0	1	0	0	6	0.146	73.000	0.190	1	1	0	1	0	0
RESVOR	0	1	6	0	7	697.100	0.000	0.000	1	1	1	1	0	0

ENDATA

END OF LISTING

PLATE D-13

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCHEMENT= 0.15
EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 01= 1 TO XSECTN/STRUCT 01= 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

100 Year Computations

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.14 INPUT RUNOFF CURVE= 75.0 TIME OF CONCENTRATION= 0.19
COMPUTED CURVE NO. = 86.8

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
9.00	7.517	(RUNOFF)
10.00	8.932	(RUNOFF)
10.95	9.960	(RUNOFF)
15.84	182.441	(RUNOFF)
16.87	68.944	(RUNOFF)
17.87	54.297	(RUNOFF)
18.92	9.057	(RUNOFF)
19.90	9.102	(RUNOFF)

HYDROGRAPH, TZERO= 6.14 DELTA T= 0.15 DRAINAGE AREA= 0.14

TIME											
6.14	DISCHG	0.00	1.42	1.85	2.23	2.60	2.95	3.28	3.61	3.92	4.21
7.64	DISCHG	4.50	4.77	5.03	5.29	5.53	5.77	6.05	6.84	7.24	7.51
9.14	DISCHG	7.26	7.14	7.27	7.72	8.46	8.76	8.90	8.37	8.32	8.44
10.64	DISCHG	9.18	9.73	9.96	9.78	9.26	9.26	9.44	10.38	10.74	11.05
12.14	DISCHG	23.78	32.73	34.94	36.02	36.84	37.59	38.84	44.55	46.75	47.73
13.64	DISCHG	49.30	50.52	51.23	55.08	62.18	64.03	64.98	66.72	67.61	68.87
15.14	DISCHG	126.98	166.66	174.56	177.77	180.36	181.86	174.02	94.78	71.87	68.56
16.65	DISCHG	68.18	68.29	68.39	63.74	54.31	52.66	52.59	53.86	54.28	54.09
18.15	DISCHG	27.77	10.34	7.68	7.00	8.85	9.04	8.93	7.69	7.32	7.28
19.65	DISCHG	8.29	8.96	9.06	8.55	7.49	7.30	7.41	8.66	9.03	9.07

Input Hydrograph

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 5.4511 CFS-HRS= 513.63 ACRE-FT= 42.44

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 697.10

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.98	179.809	699.12

HYDROGRAPH, TZERO= 6.14 DELTA T= 0.15 DRAINAGE AREA= 0.14

TIME											
6.14	DISCHG	0.00	0.02	0.07	0.13	0.20	0.28	0.37	0.46	0.57	0.68
6.14	ELEV	697.10	697.10	697.10	697.11	697.11	697.12	697.12	697.13	697.14	697.15
7.64	DISCHG	0.79	0.91	1.03	1.16	1.30	1.43	1.57	1.72	1.89	2.06
7.64	ELEV	697.15	697.16	697.17	697.18	697.19	697.20	697.21	697.22	697.24	697.25
9.14	DISCHG	2.22	2.38	2.53	2.68	2.85	3.03	3.21	3.38	3.54	3.69
9.14	ELEV	697.26	697.27	697.29	697.30	697.31	697.32	697.34	697.35	697.36	697.37
10.64	DISCHG	3.85	4.02	4.20	4.38	4.54	4.69	4.83	4.99	5.16	5.34
10.64	ELEV	697.38	697.40	697.41	697.42	697.44	697.45	697.46	697.47	697.48	697.50
12.14	DISCHG	5.72	6.42	7.28	8.15	9.04	9.91	10.80	11.76	13.27	14.91
12.14	ELEV	697.52	697.58	697.64	697.71	697.77	697.84	697.91	697.98	698.05	698.13
13.64	DISCHG	16.54	18.53	21.17	23.78	26.62	35.40	43.52	49.75	54.60	58.41
13.64	ELEV	698.20	698.27	698.34	698.41	698.48	698.55	698.61	698.65	698.68	698.71
15.14	DISCHG	73.12	107.15	137.48	159.11	170.26	176.33	177.23	153.28	117.20	95.51
15.14	ELEV	698.78	698.90	699.01	699.07	699.10	699.11	699.12	699.05	698.94	698.86
16.65	DISCHG	82.98	76.17	72.55	69.56	64.69	61.21	58.82	57.26	56.37	55.76
16.65	ELEV	698.82	698.79	698.78	698.77	698.75	698.73	698.71	698.70	698.69	698.69
18.15	DISCHG	51.62	42.54	33.19	26.87	25.56	24.02	22.80	21.61	20.46	19.39
18.15	ELEV	698.66	698.60	698.54	698.49	698.45	698.41	698.38	698.35	698.32	698.29
19.65	DISCHG	18.44	17.64	17.21	16.80	16.37	15.94	15.52	15.16	14.86	14.58
19.65	ELEV	698.27	698.25	698.23	698.21	698.19	698.17	698.15	698.14	698.12	698.11

Output Hydrograph

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.7830 CFS-HRS= 450.67 ACRE-FT= 37.24

ENDCMP 1

END OF JOB TR20 RHW

PLATE D-14

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCREMENT= 0.19
EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 07/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

100 Year Computations

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.14 INPUT RUNOFF CURVE= 73.0 TIME OF CONCENTRATION= 0.19
COMPUTED CURVE NO. = 86.8

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
9.00	7.517	(RUNOFF)
10.00	8.932	(RUNOFF)
10.95	9.960	(RUNOFF)
15.04	182.441	(RUNOFF)
16.87	68.944	(RUNOFF)
17.87	54.297	(RUNOFF)
18.92	9.057	(RUNOFF)
19.90	9.102	(RUNOFF)

HYDROGRAPH, TZERO= 6.14 DELTA T= 0.15 DRAINAGE AREA= 0.14

TIME											
6.14	DISCHG	0.00	1.42	1.85	2.23	2.60	2.95	3.28	3.61	3.92	4.21
7.64	DISCHG	4.50	4.77	5.03	5.29	5.53	5.77	6.05	6.83	7.24	7.51
9.14	DISCHG	7.26	7.14	7.27	7.72	8.46	8.76	8.90	8.37	8.32	8.44
10.64	DISCHG	9.18	9.73	9.96	9.78	9.26	9.26	9.44	10.38	10.74	11.05
12.14	DISCHG	23.78	32.73	34.94	36.02	36.84	37.59	38.84	44.55	46.75	47.73
13.64	DISCHG	49.30	50.52	51.23	55.08	62.18	64.03	64.98	66.72	67.61	68.87
15.14	DISCHG	126.98	166.66	174.56	177.77	180.36	181.86	174.02	94.78	71.87	60.56
16.65	DISCHG	68.18	68.29	68.39	63.74	54.31	52.66	52.59	53.86	54.28	54.09
18.15	DISCHG	27.77	10.54	7.68	7.80	8.85	9.04	8.93	7.69	7.32	7.28
19.65	DISCHG	8.29	8.96	9.06	8.55	7.49	7.30	7.41	8.66	9.03	9.07

Input Hydrograph

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 5.4511 CFS-HRS= 513.63 ACRE-FT= 42.44

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 697.10

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.98	179.809	699.12

HYDROGRAPH, TZERO= 6.14 DELTA T= 0.15 DRAINAGE AREA= 0.14

TIME											
6.14	DISCHG	0.00	0.02	0.07	0.13	0.20	0.28	0.37	0.46	0.57	0.68
6.14	ELEV	697.10	697.10	697.10	697.11	697.11	697.12	697.12	697.13	697.14	697.15
7.64	DISCHG	0.79	0.91	1.03	1.16	1.30	1.43	1.57	1.72	1.89	2.06
7.64	ELEV	697.15	697.16	697.17	697.18	697.19	697.20	697.21	697.22	697.24	697.25
9.14	DISCHG	2.22	2.38	2.53	2.68	2.85	3.03	3.21	3.38	3.54	3.69
9.14	ELEV	697.26	697.27	697.29	697.30	697.31	697.32	697.34	697.35	697.36	697.37
10.64	DISCHG	3.85	4.02	4.20	4.38	4.54	4.69	4.83	4.99	5.16	5.34
10.64	ELEV	697.38	697.40	697.41	697.42	697.44	697.45	697.46	697.47	697.48	697.50
12.14	DISCHG	5.72	6.42	7.28	8.15	9.04	9.91	10.80	11.76	13.27	14.91
12.14	ELEV	697.52	697.58	697.64	697.71	697.77	697.84	697.91	697.98	698.05	698.13
13.64	DISCHG	16.54	18.53	21.17	23.78	26.62	35.40	43.52	49.75	54.60	58.41
13.64	ELEV	698.20	698.27	698.34	698.41	698.48	698.55	698.61	698.65	698.68	698.71
15.14	DISCHG	73.12	107.15	137.48	159.11	170.26	176.33	177.23	153.28	117.20	95.51
15.14	ELEV	698.78	698.90	699.01	699.07	699.10	699.11	699.12	699.05	698.94	698.86
16.65	DISCHG	82.98	76.17	72.55	69.56	64.69	61.21	58.82	57.26	56.37	55.76
16.65	ELEV	698.82	698.79	698.78	698.77	698.75	698.73	698.71	698.70	698.69	698.69
18.15	DISCHG	51.62	42.54	33.19	26.87	25.36	24.02	22.80	21.61	20.46	19.39
18.15	ELEV	698.66	698.60	698.54	698.49	698.45	698.41	698.38	698.35	698.32	698.29
19.65	DISCHG	18.44	17.64	17.21	16.80	16.37	15.94	15.52	15.16	14.86	14.58
19.65	ELEV	698.27	698.25	698.23	698.21	698.19	698.17	698.15	698.14	698.12	698.11

Output Hydrograph

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.7830 CFS-HRS= 450.67 ACRE-FT= 37.24

ENDCMP 1

END OF JOB TR20 RHW

PLATE D-14